Gahanna's Broadband Strategic Plan

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An Initiative Sponsored By:
The City of Gahanna
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The Gahanna Broadband Strategic Plan was developed to ensure that Gahanna's City departments, Police, educational facilities, businesses, and households have access to the critical information infrastructure that will continue to facilitate new applications and economic growth in a knowledge-based economy. This report provides a snapshot of Gahanna's current information infrastructure and identifies new opportunities and plans to improve Gahanna's digital future. If implemented, the strategies contained within this report will transform the way the City does business. Gahanna has the opportunity to provide a platform for municipal service delivery, education and economic development that is scalable for future growth and will create a competitive advantage for the City. The development of the strategic plan and report would not have been possible without the work and collaboration of the Gahanna School District, Gahanna Police and various City departments, particularly the IT Department and its Director, Kevin Marchese.

What is Broadband and Why is it Important

Broadband services refer to high-speed Internet connections. They are important because many new web-enabled tools require high-speed connections for the applications to work. Strong levels of broadband access will allow the City and more businesses and individuals in Gahanna to participate in online technologies such as wireless water-meter reading, business-to-business (B2B) transactions and distance learning. The use and sophistication of Internet technologies increases exponentially with access to broadband.

About Whiteboard- Whiteboard is a boutique consulting firm that is a wholly-owned subsidiary of Schottenstein Zox and Dunn, Co., LPA, a progressive Columbus, Ohio based law firm. Whiteboard benefits from the resources and contacts provided by a large law firm with a significant municipal and telecom practice.

Whiteboard assists clients in developing solutions and the resources necessary to implement leading-edge broadband solutions.

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Background

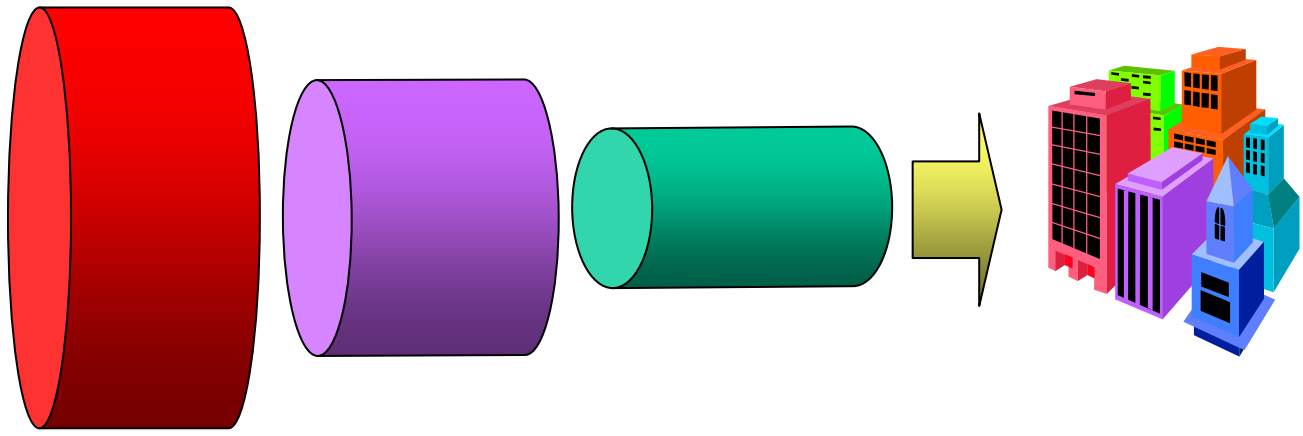
The broadband strategic plan is being developed to ensure that the City is leveraging improvements in broadband technologies and taking advantage of other regional broadband initiatives that can improve the City's service delivery, manage and lower long-term costs for required, internal broadband services and provide economic development tools necessary to attract and retain 21st Century Economic Development opportunities. To grow a healthy municipal revenue-base, today's communities are increasingly competing to provide world-class services and amenities that will incent new private-sector investments in their communities. In an effort to address this issue, Gahanna has developed a broadband improvement plan that will facilitate positive growth.

This report identifies the current level of broadband availability within Gahanna and sets forth a plan to improve broadband access for several purposes including:

- Municipal Applications
    - Wireless Meter-Reading for City Water Services
    - Traffic signaling
    - GIS for snow plow route management
    - Wireless replacement of cellular services to provide increased speeds for data and video
- Law Enforcement/ First Responders
    - Real-time, mobile capabilities that allow for data and video during traffic stops
    - Video transmitted from the cars to police headquarters
    - Disaster preparedness
- Education
    - Connecting Gahanna's schools directly to all Ohio colleges and universities through Ohio's Third Frontier Network
    - Increased bandwidth for distance-learning applications
- Research and Economic Development
- Increased Competition in the Local Market for Broadband Services households and businesses

If implemented, the result will provide a long-term cost savings to the city with increased internal efficiencies and cost savings through adoption of new applications for municipal service delivery, as well as competitive broadband access for all sectors of Gahanna that are critical to the future economic viability of the community. The plan addresses broadband access at multiple levels which goes beyond the typical municipal broadband planning efforts. The goal of this effort is for Gahanna to facilitate improved broadband access locally and not compete with private-sector telecom and broadband providers. The graphic on the following page identifies the physical network layers that will be impacted by this plan.

Gahanna's Information Infrastructure has three components:



"First Mile"	"Middle Mile"	"Last Mile"
The Global Commodity Internet	Primary Network Backbone	Broadband to the Desktop!

While each of these three network components is critical to the local information infrastructure, this project focuses on the Middle and Last Mile of broadband availability in Gahanna.

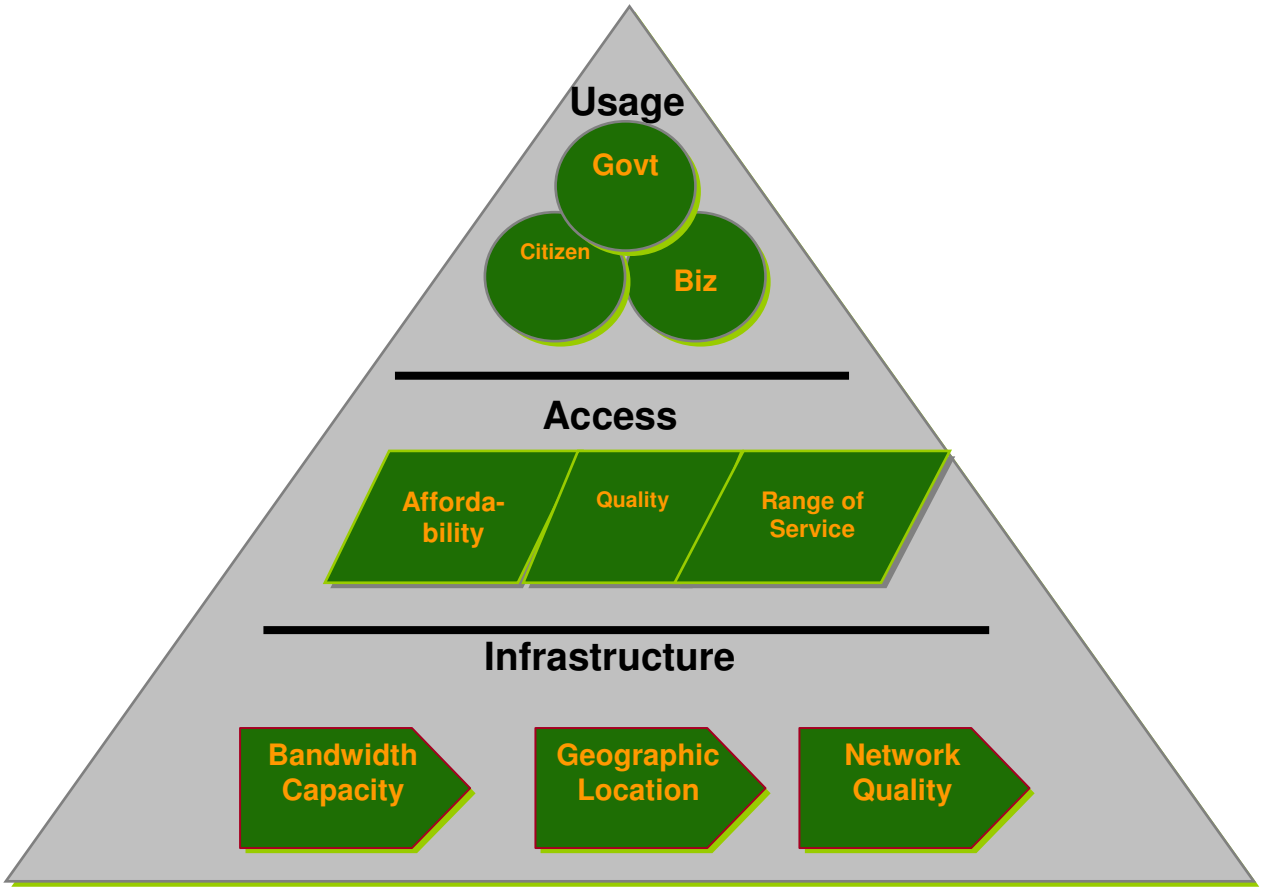
The First Mile or global commodity Internet as it is known is based on the fiber-optic networks that make-up the global network backbone. These networks connect the major information network providers around the world. Local community efforts can not impact the location of this layer of the information infrastructure, as they are determined by placement of global communication networks. Fortunately for Gahanna, the Central Ohio market has a robust investment in this network layer and many national and international communication firms have infrastructure in the market which can benefit the Middle and Last Mile networks in the region by providing connections to the global marketplace.

Gahanna Broadband Snapshot 2006

This section of the report focuses on broadband availability in Gahanna today. The snapshot includes:

- Local options for service
- Local quality of the service
- Local pricing for service

These three factors will determine what types of applications and how effectively broadband services are being used today. The following graphic indicates the impact of a robust information infrastructure on a community.



The greater the quality, location and capacity of the local network backbone, the greater the affordability and services available, thereby creating and supporting a much greater range of services and applications to support the critical stakeholders within the community and foster an environment to support municipal applications and communication, education, research and development and economic development.

Middle Mile

Today, many service providers offer Middle Mile type services that create a competitive environment for network backbone services in Gahanna. These services are the types of broadband connections typically utilized by large bandwidth consumers like companies, schools or local government entities that rely on large amounts of bandwidth to facilitate multiple enterprise applications. Companies and organizations with fiber-optic networks offering service in Gahanna today include:

- AT&T, formerly SBC
- AEP
- XO Communications
- Time Warner Cable & Telecom
- Insight Cable
- Wide Open West (WOW) Cable

Like the triangle on the previous page suggests, the greater the level of investment and competition in this level of network services that exists, the better the quality of service and price for service that is available to Gahanna and its' business and other demanding users of network services. More importantly, the greater the level of competition in the market, the more flexibility Gahanna and other business consumers are offered in terms of bandwidth and contract options for service.

While one might assume that the level of Middle Mile connectivity is sufficient for Gahanna's municipal purposes, previous municipal investments in fiber-optic networks, as well as other municipal and local networks create an opportunity for Gahanna to improve municipal and educational broadband access that will provide increased capacity and cost-savings over the long-term. While many of Gahanna's businesses have access to competitive broadband offerings and may be well situated with respect to Middle Mile connectivity, Gahanna's government, first-responders and educational facilities all have room for improvement. The Middle Mile level of connectivity is directly addressed as part of Gahanna's broadband strategic plan.

Last Mile

Like many Central Ohio communities, Gahanna has a fair degree of competition for Last Mile broadband services. Last Mile broadband connectivity refers to cable-modem, Digital Subscriber Line (DSL) and wireless broadband services. This is particularly important with respect to household and small business connectivity. Competition in the broadband market for these services has significantly lowered the cost for service and improved service quality and customer service in much of the Central Ohio market.

Cable
Gahanna is unique in that the community is served by three different cable companies, including:

- Insight
- Time Warner Cable
- WOW

While this might sound as though robust competition exists within the cable market in Gahanna, many cable consumers within Gahanna have only one choice for cable services. The community is split between Insight and Time Warner as the primary cable provider with WOW offering a competitive product to only a portion of Gahanna's residents. In many other Central Ohio communities, WOW competes head-to-head for all cable consumers which has been shown to increase service levels and decrease the cost for broadband Internet, video and telephone services.

Competitive cable services are unique in Central Ohio and are the result of Ameritech's entrance into the cable market in the 1990s. Since the Ameritech cable system formerly known as Americast was sold to WOW, the system has been upgraded to provide two-way data transmission and WOW has marketed bundled services aggressively to the benefit of household cable consumers in the market.

Both Time Warner and Insight have upgraded their cable plant in Gahanna to provide two-way data transmission, thereby facilitating cable-modem broadband access and digital or Internet Protocol (IP) telephone services. Because cable television was developed originally as a household consumer product, the cable infrastructure follows residential rather than commercial build-out. In many instances, small businesses near but outside the cable television footprint do not have access to cable-modem services and the expense of extending the cable plant makes it cost prohibitive for the potential business-class customer or the cable provider to extend the cable network. This is changing in Gahanna to a degree as cable companies aggressively pursue business-class customers.

The expansion of cable-modem broadband services and the marketing of bundled cable services (which includes television, high-speed and broadband Internet and phone service) have helped to improve the rate at which consumers' transition from dial-up to broadband services.

Telephone
On the telephone side, AT&T provides DSL service to some household and business consumers in Gahanna. Limitations of the DSL technology prohibit some from accessing this service. DSL is a technology facilitated by the telephone company installing a piece of hardware called a DSLAM into the telephone Central Office (CO) which enables the standard copper telephone lines to transmit data at broadband rates. In theory, those household and business customers that reside within 18,000 feet or

roughly three miles of the CO have access to DSL service. Due to the nature of the copper telephone plant, this estimate generally overestimates DSL access, which is true in Gahanna. Given the number of telephone COs serving Gahanna's residents and businesses, DSL should be available ubiquitously. Due to the limitations of the technology however, the service is not available to everyone. As a result, some of Gahanna's households and businesses are not part of a competitive environment for broadband service.

Like many Central Ohio communities, AT&T has aggressively approached the City to roll-out their new video service and enter into a contract that will facilitate new fiber-based investments primarily for residential consumers in Gahanna. This product is generally referred to as Project Lightspeed and it represents AT&T's attempts to enter into the video market and provide bundled services to compete with the cable companies. While this technology (effectively an upgraded DSL service that brings fiber to a node located within a neighborhood prior to sending the video and broadband service over existing copper wires into the household) promises additional competition within the market for broadband services, many regulatory issues still need to be resolved.

Wireless

Wireless broadband services refer to any number of technologies that facilitate broadband services via a wireless-based infrastructure. Some common forms of wireless broadband service include:

- Wi-Fi or HotSpots
- Point-to-Point
- 3G (third generation) Cellular

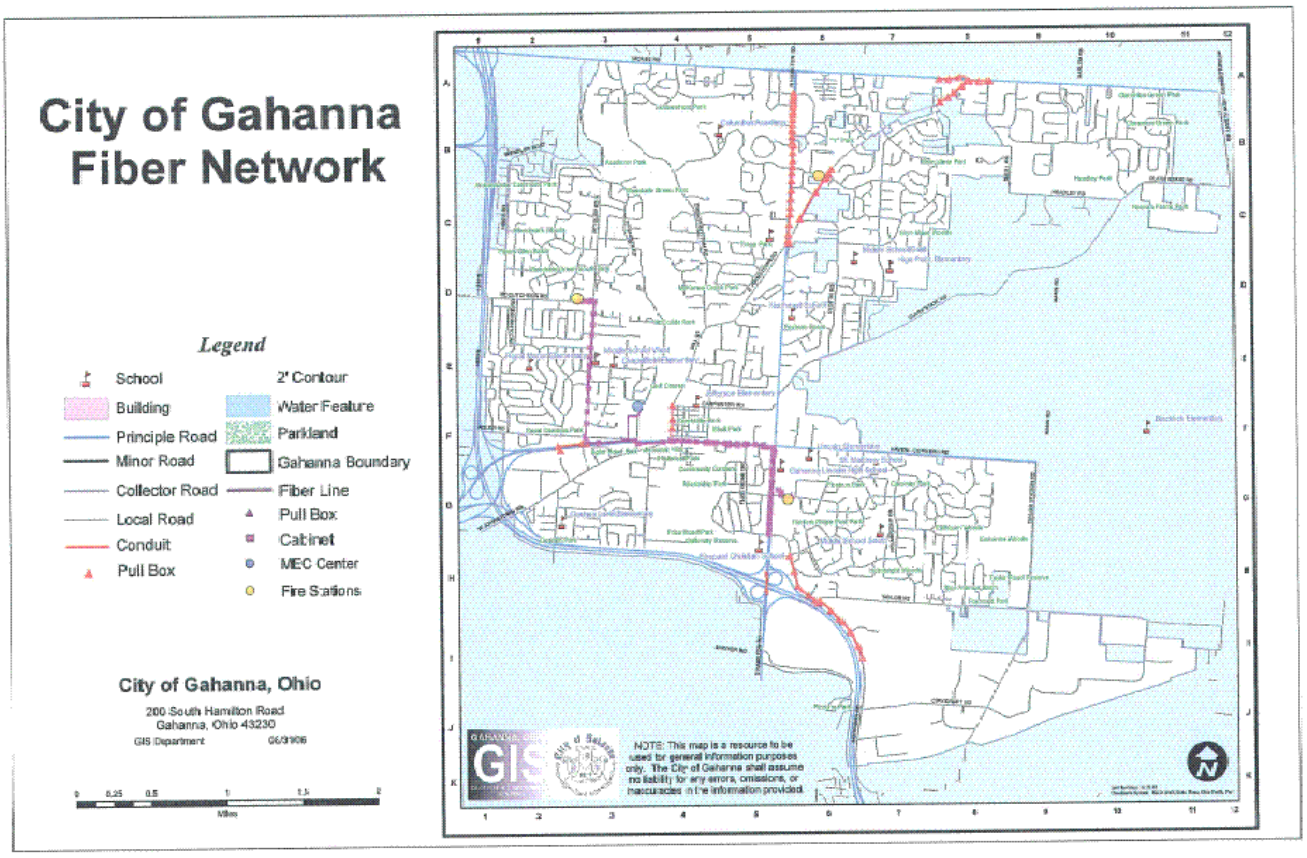
Currently, Gahanna has a few providers of traditional wireless point-to-point broadband service and several 3G cellular broadband providers. While 3G does not facilitate the capacity of traditional wireless broadband, it does allow for mobility. 3G services are great for checking e-mail and even viewing the Internet in some instances, but are not sufficient to support the kinds of applications that require more robust connections. Like a cell phone, the protocol used in the cellular network allows mobile devices such as Personal Data Assistants (PDAs) and laptops to stay connected as they move by or pass through multiple cells or towers within the cellular infrastructure. Cellular providers have generally upgraded their networks in markets like the Central Ohio market to provide these services. 3G services exist fairly ubiquitously in Gahanna as evidenced by the Police utilization of the 3G network locally.

Traditional wireless broadband exists today in Gahanna in the form of Wi-Fi hotspots in condominium complexes and coffee shops and more robust point-to-point connections available through wireless broadband providers like Celerity Networks, a Columbus based Wireless Internet Service Provider (WISP). The advantage to using this type of connection over the 3G connection is that more bandwidth is available to the end user.

Due to improvements in wireless broadband technologies, wi-fi networks are now being developed that provide for mobility like the 3G networks, but with the capability to move significantly greater amounts of data. This represents the difference between the Police accessing graphics, video or photo identification wirelessly versus data only through the 3G networks.

Public Sector Connectivity

Currently, Gahanna utilizes a mix of owned fiber-optic network strands, leased T1 circuits and 3G wireless and radio services to provide the necessary connectivity for municipal, educational and Police facilities, as well as connectivity for municipal employees in the field. The map below represents Gahanna's current fiber assets.



The City of Gahanna owns multiple strands of fiber-optic cable that reside in conduit on Hamilton Road that run to the North (24 strands), starting roughly at City Hall. The conduit turns West along Granville Street (12 strands), which turn into (144 strands) just before Ridenour, then North on Stygler Road and terminates near the intersection of Stygler and McCutcheon Roads. The fiber was developed for a mix of municipal uses including traffic signal control and municipal communications.

Gahanna Schools have also partnered in portions of the fiber network for educational connectivity. The City's fiber is used for reliable, high capacity local networking, as well as delivery of Internet services to remote City locations. In addition to carrying local data and voice traffic, these same fibers carry Internet traffic over a pair of bonded T1's, which originate in City Hall at a cost of $1050 per month.

The Gahanna-Jefferson School's connection to the fiber network include direct connections to the high school and administration building on Hamilton Road, as well as direct fiber connections to Lincoln and Chapelfield Elementary Schools, and Middle School West. Without the purchase of new hardware to expand the capacity of the fiber, portions of the network are at maximum capacity and can not be utilized for additional services.

Both the City and Schools lease multiple T1 (1.5Mbps) connections from communication service providers to connect locations outside the fiber footprint. The City pays roughly $300 per month (each) to lease T1 point-to-point circuits that serve the Streets building and the Service garage. Additionally, the Service garage is connected via wireless broadband to the Parks facility located on Oklahoma Avenue. The City also maintains a fractional T1 circuit for redundancy purposes at City Hall.

The Gahanna Schools pay roughly $950 per month per location for managed T1 circuits to their facilities not located on the fiber footprint. The managed service provides the schools with additional applications and functionality on top of the bandwidth alone. The Gahanna Police use the same bonded T1 shared by other City departments and also utilize a 3G service for mobile wireless connectivity in the police cruisers which is connected to laptop computers in the car. Both municipal and police employees utilize push-to-talk service for internal communications.

The demand for broadband services within Gahanna local government, Police and the school system is increasing at a rapid pace. As the City looks to develop applications to increase efficiencies and the schools develop new materials and further integrate technology into the curriculum, additional broadband access will be critical to meet the growing demand to service and support the new applications.

Snapshot Conclusion

While some of Gahanna's households, public and commercial entities have access to sufficient levels of Last Mile wired broadband services today, the level of competition is not equal throughout Gahanna. Additionally, competition is not as robust in Gahanna as other communities in Central Ohio. Many Central Ohio communities have more robust competition that is ubiquitously available between and among competing technologies such as cable-modem and DSL providers. Wireless broadband services in the city do not exist at the same level of other neighboring communities that are currently planning or in the process of building broadband networks. Anecdotal evidence suggest that some households and small businesses have only one choice for broadband access, while others have much more robust competition within the same

market. Equity for all households and business broadband consumers within the community needs to be a priority.

While the Middle Mile market for broadband service in Gahanna appears to be competitive enough to support the business community, the City and other public organizations have the opportunity to leverage previous investment both internally and externally to provide more bandwidth for future applications and control costs for service in the long-term.

Gahanna Broadband Strategic Plan

Gahanna has discussed improving broadband access for several years and this project was developed to highlight local goals for broadband access and develop solutions and strategies to implement the identified goals. The significant goals include:

- Implementing a wireless meter reading system
- Improving wireless broadband access for municipal and police applications
- Improve the City's broadband infrastructure to improve access for municipal purposes and control broadband costs in the long-term
- Create a connection to Ohio's Third Frontier Network (TFN) to facilitate economic development and improve educational access in Gahanna
- Encourage competition in the broadband market locally to increase service levels and reduce the cost for broadband service locally in the consumer and business markets

This section of the report deals with solutions developed to address the identified goals in Gahanna. If the findings and recommendations identified are implemented, Gahanna has some exciting potential to become a true leader in the networked-world.

Last Mile

To address the Last Mile issues that exist in Gahanna today, i.e. the lack of equity in broadband options for household and small business broadband consumers, the Broadband Improvement Plan focuses on enticing more competition into the local market for service. The first component is to entice a wireless broadband operator into Gahanna that will assist with municipal needs as well as provide a competitive broadband offering for businesses and households. The second is to pursue AT&T to deploy Project Lightspeed within the City to introduce a competitive video and broadband product. The City is currently in discussions with AT&T to pursue this alternative.

Wireless Broadband

From a strategic stand point for Gahanna service delivery, pursuing the deployment of wireless broadband is the single most important priority. As part of the development of

this project, Gahanna has also aggressively sought to encourage wireless broadband investments within the community. The goal has ***not*** been for Gahanna to become a provider of wireless broadband service, but rather for Gahanna to facilitate new broadband access by acting as a catalyst for new investment.

The initial recommendation is to develop a wireless broadband plan that will provide a backhaul mechanism for the wireless meter reading system the Service Department is pursuing. In addition to having wi-fi availability in some key locations like Creekside for official city use provisions would also be made for the casual Internet users to have similar access. Through conversations with several wireless providers, it was determined that ubiquitous coverage was more of a reality than anticipated, and at a much lower cost. This type of wireless broadband coverage can facilitate new applications and replace current technologies the City pays for monthly. The completion of the recommended municipal fiber network highlighted later in this report will significantly benefit the wireless network capacity by effectively injecting the wireless network with high bandwidth by providing backhaul for Intranet/Internet traffic over the fiber infrastructure.

The City's approach focuses on developing a cost-effective, fiber supported, wireless broadband system that can support and compliment a wireless meter-reading system for the City's water department. This has the potential to fundamentally alter the way in which the City water department conducts business today by improving customer service through

- on-demand meter reading
- city cost control through dynamic leak detection and
- the creation of more consumer friendly options like monthly billing.

Implementing such a system will reduce the number of slow or no pay consumers due to more budget friendly monthly invoicing options.

Because the wireless network the City is pursuing is capable of supporting a mesh type architecture (similar to how cellular networks operate), this will allow for mobile communications capabilities well beyond what is currently available through traditional means. This network can provide significant cost savings and benefits to local police, other first responders, and other municipal departments and employees. Some examples to illustrate this point include:

- High Speed network access to support the wireless meter-reading system
- Wireless VoIP phones for all municipal employees who currently require city-provided cellular phone service
- The ability for an ambulance and other emergency services to stream video or vital statistics to the emergency room prior to arriving with an incoming patient
- Expanded remote traffic signal control for on-demand timing adjustments and emergency overrides
- Wireless cameras in targeted locations to enhance safety and EMA operations

- Wireless network access for city employees in the field providing access to mission critical systems such as GIS, engineering drawings and other key applications for service and emergency repairs
- More efficient use of current employees in the field by reducing the lost time from trips to city buildings to retrieve data, maps, and other key information

The combination of increased backbone capacity and last mile wireless broadband access has the potential to transform many time sensitive administrative functions within the City and will ultimately improve efficiencies and customer service delivery while also controlling costs.

Gahanna has the opportunity to achieve a favorable service agreement from a wireless broadband vendor. This service agreement would be dependent on offering access to municipally owned assets such as light poles, mast arms, traffic signal poles, building roofs, towers, etc. for wireless access point radio placement and access to the city's fiber assets for data backhaul in exchange for new investments and reduced cost broadband service within the City. This strategy works effectively if Gahanna partners with a provider willing to make a significant portion of the capital investment in exchange for access to these municipal assets. Any agreement will include the service level requirements and guarantees necessary to run mission-critical operations.

Creating this type of partnership is critical to enticing private investment within the community and will provide another competitive broadband offering for households and small businesses. Citizens could also use this to access wireless broadband service on their laptops or PDAs in parks and other outdoor spaces and the Police, emergency services and city staff could use this access for administrative purposes as outlined earlier in this document.

The end result of this type of investment by a private company in the City will effectively create a wireless broadband cloud over the City that can be used for many different municipal purposes. Since reliability will be key to support certain official operations these types of wireless networks can be programmed to provide priority to certain users like the Police and other emergency personnel.

As part of this wireless strategy, Gahanna is seeking not only a provider who will invest in the community, but a wireless broadband provider with the capability to provide mobile access to broadband services. As was mentioned previously, this type of access can provide tremendous benefit to first responders and other official city service personnel, while creating a more meaningful connection for residential broadband consumers. This type of network will bring the mobility benefits of 3G cellular based networks with the capacity of a Wi-Fi connection, effectively giving Gahanna the best of both worlds. Although no partnerships have been finalized, Gahanna has taken great strides to bring greater competition into the local market. The end result will be improved rates and services for local broadband consumers through the City's efforts to entice another private-sector broadband provider into the local market.

A wireless broadband network of this magnitude will provide the Police with a replacement service for their current 3G connections, as well as replace the push-to-talk service for all municipal employees. The cost savings for replacing the 3G service (limited capacity that can not support video and large amounts of data) can be used to support this new service which will provide much greater functionality and options.

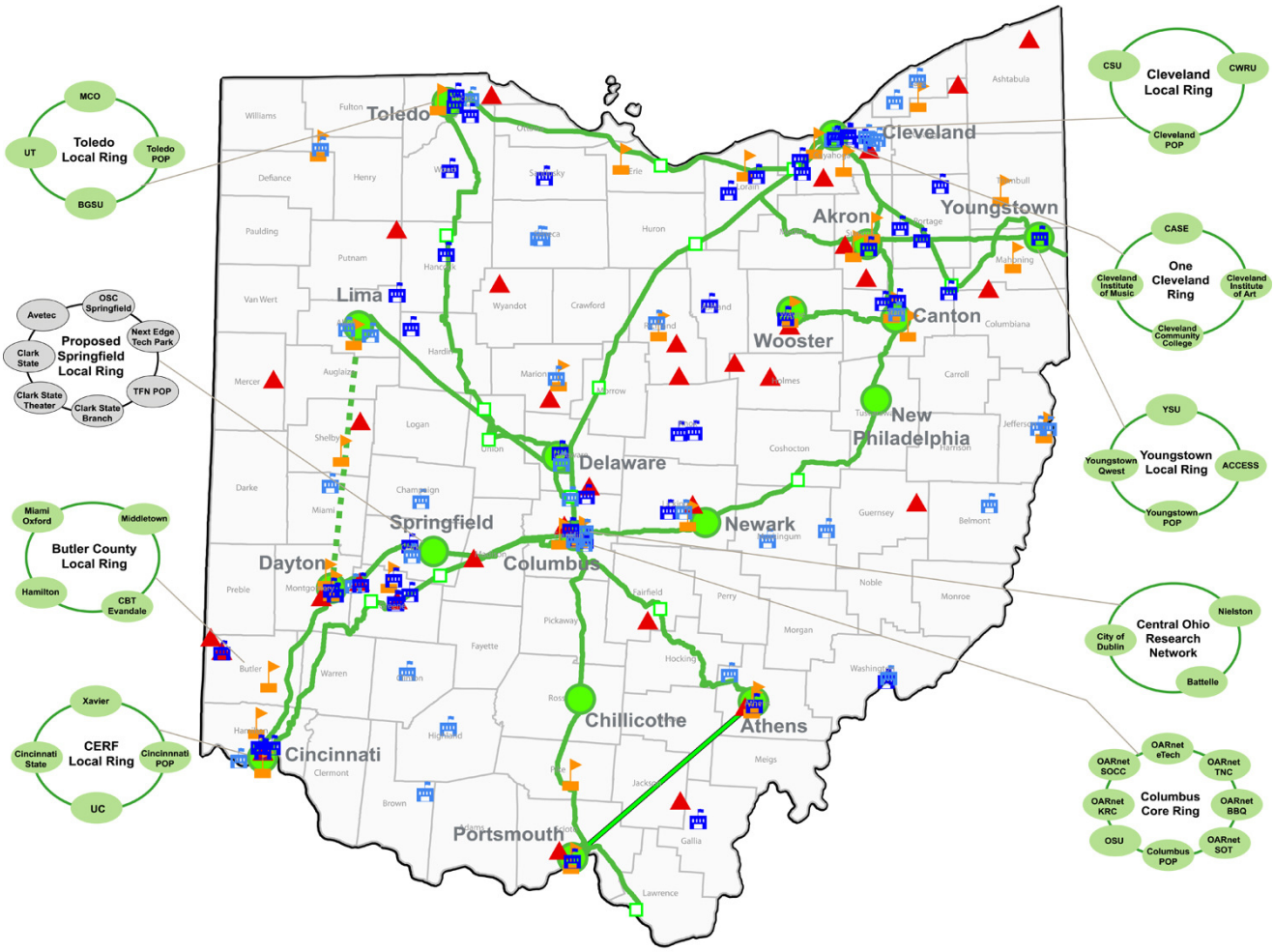
Middle Mile

As previously mentioned, Gahanna does not need to address Middle Mile connectivity for businesses. A competitive market for this level of service exists today. Where Gahanna can have a positive influence on Middle Mile connectivity is specifically for municipal, educational and economic development purposes. One of the main strategies and keys to facilitating this process is to create a direct connection to Ohio's Third Frontier Network (TFN).

As a backdrop, this project in Gahanna was undertaken in the context of two significant broadband improvement projects within the State of Ohio. The TFN (see map on the following page) is a dedicated high-speed fiber-optic network linking Ohio colleges and universities with research facilities to promote research and economic development. Over 1,600 miles of fiber have been purchased to create the backbone network to connect colleges and universities, K-12 schools, and communities together (http://www.osc.edu/oarnet/tfn/index.htm).

Additionally, OH*1 (http://oit.ohio.gov/cio/OIT10.aspx) is a statewide effort led by Ohio's Office of Information Technology (OIT) within the Department of Administrative Services to consolidate all networking for the State Executive Branch agencies, as well as provide broadband access to Ohio's local governments and court system. This new access can be utilized by the City for remote video arraignments or other applications that can save the City money over time. Although OH*1 is still in the development stages, Ohio's next governor intends to utilize the network to provide connections to this network for municipalities. Since TFN will act as the backbone to the OH*1 network, a local connection to the TFN will in turn provide Gahanna with a local connection to OH*1.

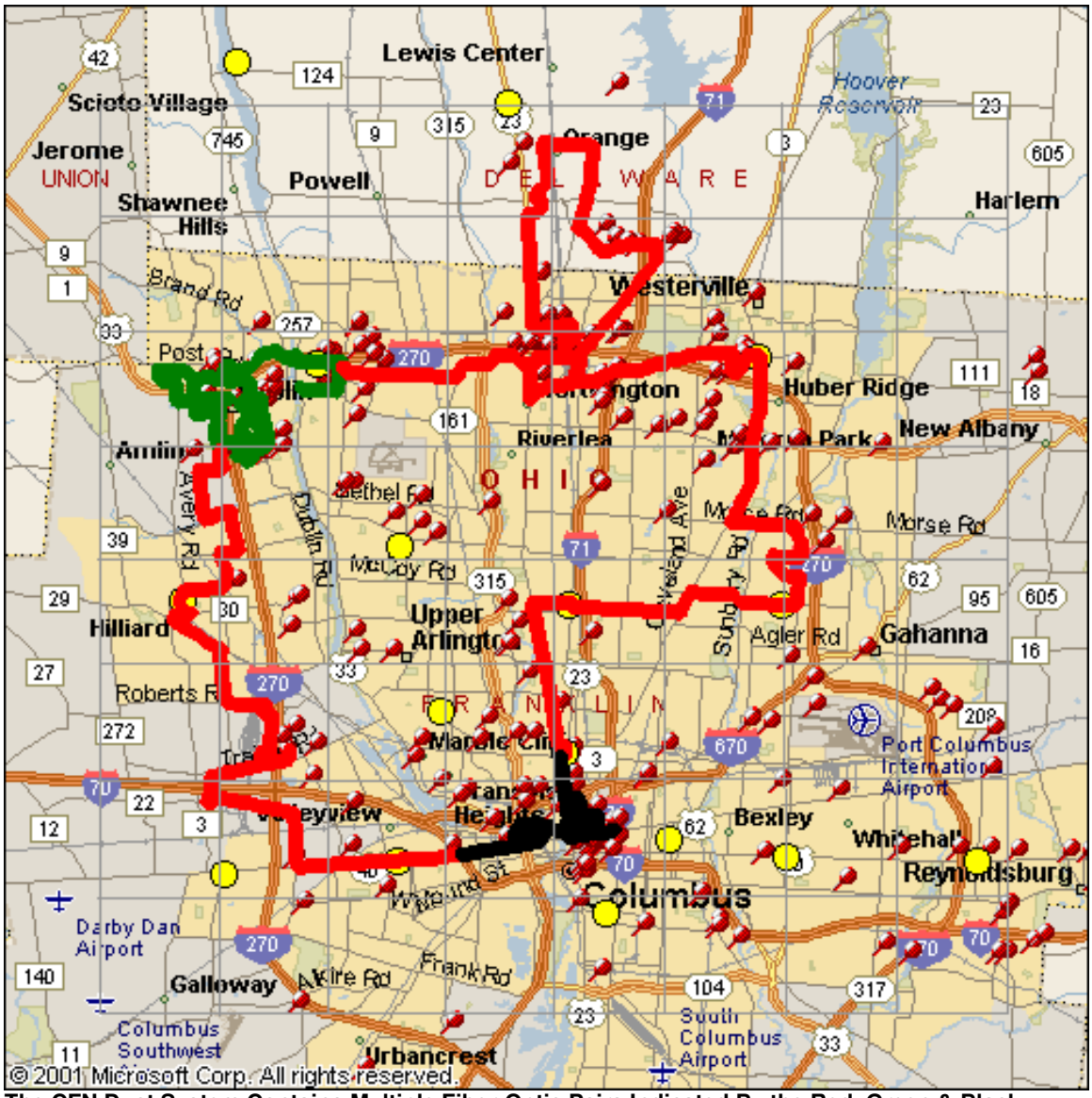
Since the Gahanna broadband strategic plan is designed to improve overall broadband access, both projects need to be considered as a potential source for broadband infrastructure improvements. Although the TFN backbone is already constructed and operational, Gahanna has the opportunity to directly connect to the backbone at a local connection point via a fiber-optic based connection. This type of connection has the potential to positively impact connectivity for local government and educational purposes, as well as serving research and development and economic development needs.



Since a connection to the TFN is seen as a critical solution to improving Middle Mile connectivity for municipal and educational purposes, it was determined that Gahanna needs to obtain access to fiber to make the physical connection to the TFN backbone. Because the TFN does not have a Point-of-Presence (PoP) in Gahanna, a plan was developed to connect through another local network which does connect to the TFN. These local and regional network backbones are only as powerful as they are connected to other networks. Fortunately for Gahanna, the Columbus FiberNet (CFN) exists and can act as a mechanism to facilitate a connection between the TFN and any new fiber network within Gahanna.

The CFN (see map on the following page) duct system consists of 70 miles of twenty 1½ inch innerducts connecting businesses and communities. The network essentially follows I-270. CFN is privately owned by the Fishel Company and was developed as a technology asset to attract high tech companies and spur economic development. If Gahanna connects to the CFN, that connection will facilitate direct connections to the TFN and all the Tier 1 commercial providers that utilize the CFN to connect to large customers. Effectively, the CFN will provide Gahanna with a fiber-based gateway to the

global commodity Internet that could never be achieved through attempting to purchase this type of connection in the market.

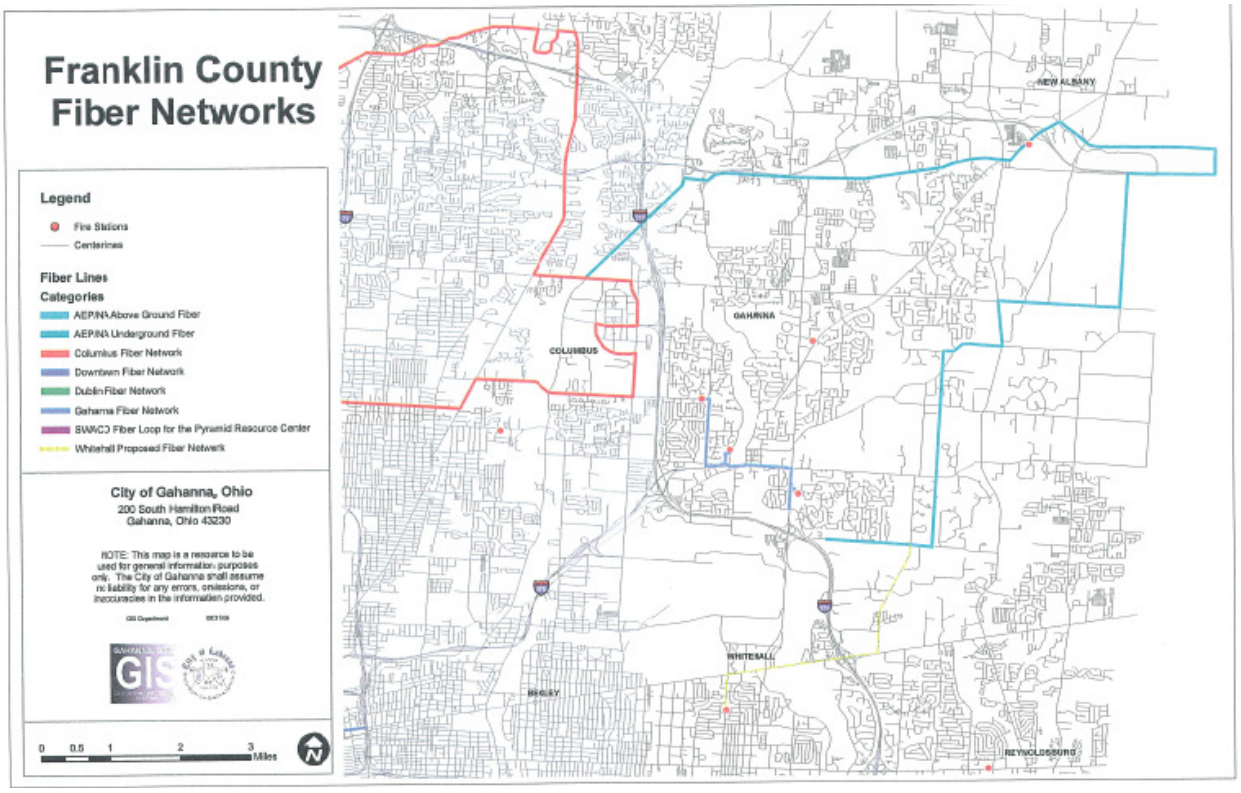


The CFN Duct System Contains Multiple Fiber-Optic Pairs Indicated By the Red, Green & Black

As part of the plan, Gahanna needs to develop a mechanism to connect to the CFN.

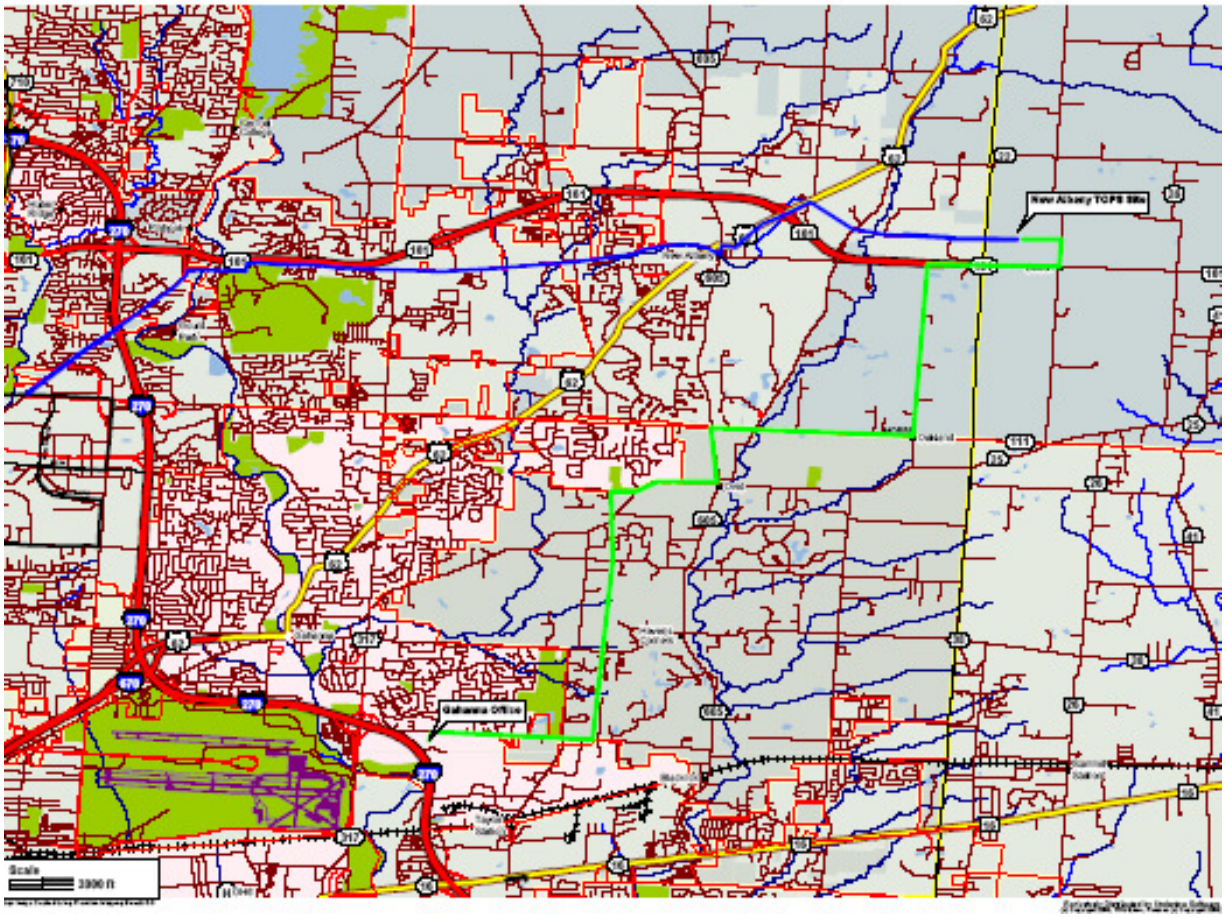
Since building and maintaining fiber-optic networks is a very daunting and expensive proposition, developing a partner to facilitate the connection was necessary. Gahanna worked with the Village of New Albany hoping to facilitate this redundant connection to the CFN and TFN.

The following map portrays how the investments in Gahanna would connect to the CFN and New Albany network.



Previously, New Albany had sought a similar connection to both the TFN and CFN, but for slightly different reasons. New Albany lacked the competitive environment for Middle Mile services that exists in Gahanna and wanted to pursue a fiber-optic network plan that could be utilized for businesses as an economic development tool. To achieve this, New Albany partnered with American Electric Power (AEP) to build the fiber-optic network backbone. Since AEP was in the process of identifying a location within New Albany to locate their new administrative and transmission facility, New Albany approached AEP as a potential partner for this project. As it turns out, AEP was considering several options for connecting their new facility to their own fiber optic network. After several conversations and negotiations, New Albany was able to partner with AEP to share in the costs of building and maintaining a fiber-optic network that connect to the CFN (see map below). The good news for Gahanna is that New Albany's fiber-optic network terminates at the AEP facility in Gahanna and New Albany needed an additional connection to the CFN so that their network backbone had redundant connections to the CFN for failover reliability.

Exhibit A



Black- CFN **Blue-AEP/NA Underground Fiber** **Green- AEP/NA Above Ground Fiber**

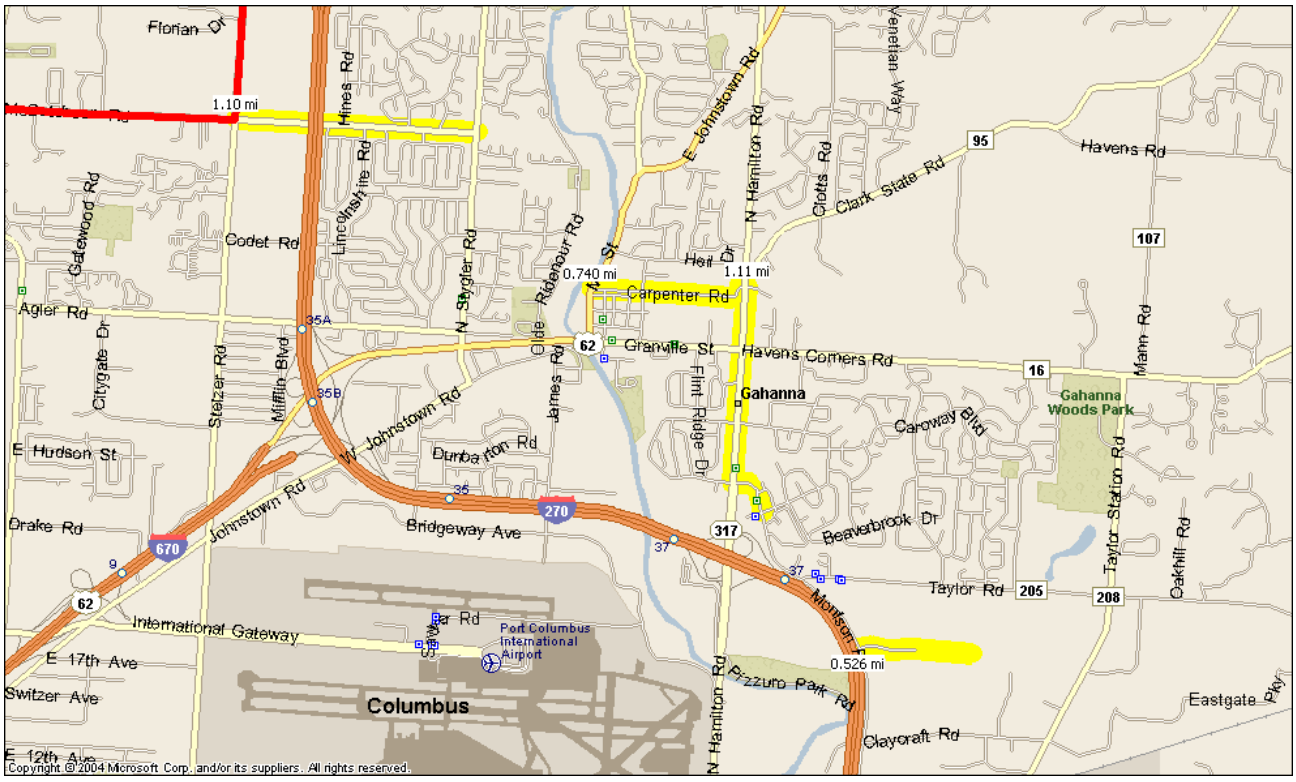
The New Albany network backbone consists of 96 strands of fiber that can be utilized for municipal, educational and economic development purposes. Gahanna, through a minimal capital investment, can extend the current fiber network that exists in the City to connect to the CFN and offer fiber capacity in-lieu of fees to New Albany to create a municipal partnership that helps both communities. This strategy provides an opportunity for municipal collaboration that has not existed to date.

Gahanna Fiber Network

Whiteboard recommends a phased approach for constructing a fiber-optic backbone for Gahanna. Phase 1 is intuitive and is based on existing facilities and projects in Gahanna or those currently under development. Phases 2 and 3 will provide Gahanna with network growth capacity in critical areas that will need additional broadband access in the future.

Phase 1

Referring to the map of Gahanna's current fiber assets, Gahanna currently needs less than two total miles of new fiber and conduit to complete the connection in concert with New Albany. The City has a policy adopted by council of building conduit as part of all new road and waterline construction projects. The City is currently constructing conduit on Morrison Road heading south towards Tech Center Drive; which is close to the location that the New Albany fiber terminates at the AEP facility in Gahanna. Fiber and conduit needs to be constructed from a location just outside the AEP facility in Gahanna where New Albany's aerial fiber ends and connected to the conduit system at the intersection of Tech Center Drive and Morrison Rd. Fiber then needs to be installed in the new conduit to connect with the City's existing fiber on Hamilton Road, as indicated in the map below.



Because the existing city owned fiber along Granville street is at maximum capacity, it will be necessary to extend the new fiber north to Carpenter Road by way of Hamilton Road and then install the fiber west to Mill Street where the City is again constructing

conduit as part of the new Creekside Development project. Additionally, this route will provide the local school district access to a fiber connection for Jefferson Elementary on Carpenter Road. The new fiber should then intersect with and connect to the existing city owned fiber at Granville Street, which is part of the existing fiber network extending west to North Stygler Road and terminating at McCutcheon Road. From there, new fiber and conduit needs to be constructed to connect to the CFN at a junction box where McCutcheon Road effectively intersects the CFN network. This strategy will provide Gahanna with an incredible opportunity that could not be completed on its own.

Again, the goal is not to compete with private-sector telecom companies to provide high-bandwidth services to their customers, but rather to utilize the fiber to maintain a scalable high bandwidth connection for municipal, educational and economic development purposes.

Examples of the goals include:

- Gahanna can utilize a certain number of fibers for municipal/administrative purposes. This will also provide a direct connection to the OH*1 network, effectively allowing Gahanna to purchase bandwidth reasonably through the State with virtually unlimited capacity for communication and collaboration purposes. Additionally, Gahanna can utilize the fiber network to provide bandwidth to any wireless broadband projects.
- Gahanna can utilize the fiber to increase access to the fiber-based traffic signaling project.
- Gahanna can partner with the School District to utilize a dedicated amount of fibers to increase capacity to broadband services and help the District maintain cost controls over the long-term. Educational institutions are utilizing increasing amounts of bandwidth annually, which increases their telecommunication costs. By effectively "owning" fiber for educational purposes, the District can roll the annual payments currently allocated to broadband into the capital expense of the fiber. Utilizing this model, the fiber will pay for itself after a few years in the form of annual cost savings.
- The Gahanna Police can utilize a dedicated number of fibers for law enforcement purposes.
- Gahanna can offer fibers as an economic development incentive to companies and research facilities contemplating relocation as part of business growth and retention efforts. Because the network will be connected to the TFN, companies locating in Gahanna will effectively be directly connected to any university or research facility throughout Ohio. This has the potential to develop high-wage knowledge-based jobs that will be critical to the future economic health of the City.
- Gahanna can offer fibers to healthcare providers contemplating relocation to the City as an economic development incentive. This will create connections to other Central Ohio locations that are currently connected to the CFN.

The possibilities are limitless. The recipients of the fiber will be responsible for purchasing the necessary services or equipment to utilize this asset. Again, under this scenario, Gahanna is merely facilitating state-of-the-art broadband connectivity, not providing the actual service or competing with private-sector network providers. In fact, this asset may prove to increase private-sector network services within the Gahanna market.

Additionally, these costs can be shared with Gahanna Schools to create a partnership to offset some of the capital costs. Gahanna Schools are independently looking at direct fiber connections to Goshen and Royal Manor Elementary Schools in conjunction with Phase 1 of the project.

While developing this type of municipal fiber network ultimately will be a significant investment, it is an opportunity that can pay for itself over time. This recommendation would not be possible were it not for the other municipal and regional networks that are contiguous to Gahanna today. The New Albany network backbone will be complete by July, 2007, so Gahanna has the opportunity to connect to this network in the very near term. Gahanna will recover the investment it makes in constructing and utilizing the new network in a matter of years, in the following ways:

- As information technology budgets increase within the City over time, those costs can be diverted to the fiber project. Additionally, the City and its departments will have access to new capacity previously unavailable or cost-prohibitive.
- One significant economic development project that results from the existence of the network will more than cover the initial capital costs of the project through additional tax revenues generated by this potential new development in a short period of time.
- The City will now be able to aggressively pursue corporations or research institutions with a need to connect directly with other research facilities around Ohio.
- The network will create new opportunities for the City to pursue state and federal research and development funds previously unavailable to Gahanna.

The end result for Gahanna will be an incredible return on investment if the City aggressively utilizes this asset to its advantage.

Phase 2

After the construction of the first phase of the network is complete, Gahanna may wish to pursue extending the network into key areas of the City for municipal, educational and economic development purposes. The logical extension for the 2nd phase of the project will be to connect the service garage location in a redundant loop that can also provide connections to the landfill site being developed in the Southeast corridor of the City. Tech related development is appropriate for the site and access to fiber and the TFN can be utilized as an economic development tool in addition to connecting another City facility. This can also be used as a mechanism to connect school locations in the Southeast corridor of the City. Cost estimates can be developed if the City determines to pursue a 2nd phase of fiber development.

Phase 3

Phase 3 would include extending fiber North of Granville Road on Hamilton Road. The City is in the process of constructing conduit as part of the road project on Hamilton Road, with the eventual goal of having conduit from Gahanna's northern border running South on Hamilton Road to City Hall. It would be logical and inexpensive to pull fiber through that conduit once it is constructed. This will also create a mechanism to assist the Schools in addressing connectivity issues in the northern parts of the City.

Conclusion

The Gahanna Broadband Strategic Plan addresses the key constituencies Gahanna wished to target at the outset of the project including:

- Municipal Service Delivery
- Police
- Education
- Businesses
- Economic Development
- Research & Development
- Households
- Wireless Mobile Access

If implemented, Gahanna will be well positioned to take advantage of broadband technologies and utilize this access as a tool to improve the delivery of municipal services. Both the fiber-based and wireless solutions recommended in this project should be significantly less expensive to implement as the result of the planning process and developing creative partnerships. Additionally, these strategies will improve law enforcement capabilities and create a new climate for economic development. If the projects identified within the Broadband Strategic Plan are implemented, Gahanna will become a recognized leader in the municipal environment. The possibility and potential generated through implementing these projects is limitless and will create a distinct competitive advantage for the City.

Recommendations for Implementation & Next Steps for Gahanna

1. Develop a pilot project with a selected wireless meter-reading firm and a WISP to ensure that the proposed solution delivers on its promises. This is a significant municipal investment and should operate as advertised.

2. Develop and release an RFP for ubiquitous wireless broadband service throughout the City. Utilize existing municipal assets to create a partnership for the service. Approach the project as a managed service rather than purchasing wireless assets to be managed internally and ensure that the successful bidder provides wireless broadband services to residents and businesses as part of the agreement. Ensure that the selected wireless vendor collaborates with the selected vendor for the wireless meter-reading project to leverage City investments that should be mutually beneficial.

3. Identify the partnerships (schools, townships, etc.) that need to be developed that will be critical to implementing the technology strategic plan.

4. Identify creative funding mechanisms like the Capital Budget request to offset the capital expenses of implementing the recommendations.

5. Work with New Albany to partner on the fiber network that will provide the critical redundancy currently lacking in New Albany's network and provide Gahanna a connection to the CFN. Develop a deal to share fiber in-lieu of payments or fees in each network to facilitate this process.

6. Complete the remaining links in the fiber network as recommended to connect Gahanna's current fiber-optic backbone to the CFN and the TFN.

7. Identify the critical applications for municipal/administrative purposes to implement in the near term. In dealing with limited resources, the City will want to employ the new applications that will create the greatest return on investment.

8. Encourage collaboration among all municipal departments throughout the implementation process to ensure all City assets are leveraged and taken advantage of.

9. Encourage competition and new investments in the broadband market in Gahanna. This can be accomplished through pursuing Project Lightspeed and new wireless broadband providers to improve last mile connectivity.

10. Develop the mechanisms and policies for economic development-based connections to the fiber network in Gahanna. This will be based on the

recommendations contained in the Fiscal Impact Analysis and resulting Economic Development Plan adopted by the City of Gahanna.

11. Pursue a connection with the TFN as soon as the fiber backbone is in place.

12. Dedicate internal resources to implement the various recommendations of the report. The recommendations will require significant time and planning to implement effectively.

13. Create a public relations campaign to highlight Gahanna's assets and activities as an economic development tool.

Glossary of Broadband Terms

Access: The technology choices available by which users can connect to the public data network at the level they demand or need (dialup, cable, DSL, ISDN, wireless, fiber, etc.)
B2B (Business-to-Business): The exchange of products, services, or information between two or more businesses using networked technologies.
B2C (Business-to-Consumer): The exchange of products, services, or information between businesses and consumers over the Internet.
Backhaul: Moving data over a network back to a central administrative location prior to sending it out to the Internet.
Bandwidth: The amount of data that can be transmitted in a given amount of time over a particular connection.
Broadband: Data transfer over 200 Kbps. DSL and cable modem services are broadband services.
Cable modem: A device that enables a personal computer to be connected to a local cable TV line and receive and send data.
Dial- up access: Refers to connecting to the Internet via a modem and standard telephone line.
DSL (Digital Subscriber Line): A technology which enables the ordinary copper component of telephone lines to carry data at rates much higher than ISDN.
E-commerce (Electronic commerce): Commercial and non-commercial transactions facilitated through the use of networked technologies.
EDI (Electronic Data Interchange): The transfer of data between companies using computer networks, such as the Internet.
Gbps (Gigabits per second): A measurement of the rate of speed at which data is transferred (e.g., 1 Gbps equals 1 billion bits per second).
Infrastructure: The communication networks that connect users to the Internet.
IT (Information Technology): The broad subject concerned with all forms of technology used to manage and process information electronically.
ISDN (Integrated Services Digital Network): A service that allows for higher data transmission speeds and is capable of handling at least two services over one line simultaneously (i.e., voice and fax or voice and data).
ISP (Internet Service Provider): A company or organization that provides users with connectivity to the Internet.
Kbps (kilobits per second): The rate of speed at which data is transferred (e.g., 1 Kbps equals 1,000 bits per second).
Last mile: The connection from the ISP to the user's desk- top.
Mbps (Megabits per second): A measurement of the rate of speed at which data is transferred (e.g., 1 Mbps equals 1 million bits per second).
OC192 (Optical Carrier level-192): An optical fiber line that supports digital signal transmissions at 48 times the base rate of 51.54Mbps or approximately 9.7 Gbps.
T1: Dedicated phone connection providing maximum speeds up to 1.544 Mbps.
Telecommunications: Refers to all types of data transmission, from voice to video.
Usage: The extent to which business, government and household users utilize the Internet access and infrastructure available to them.
Wireless access: A communications system in which radio- frequency or infrared waves carry a signal through the air, rather than along a wire.
World Wide Web (www): The system of Internet servers and users that support documents formatted in the HTML language.

Wireless Glossary of Terms

Definitions within this glossary of terms were provided by the CTIA www.ctia.org/index.cfm and the IEEE (American Institute of Electrical Engineers) www.ieee.org/portal/index.jsp?pageID=home.

3G - The third generation of mobile communications specified by the ITU promises to offer increased bandwidth and high-speed data applications up to 2 Mbps. It works over wireless air interfaces such as GSM, TDMA, and CDMA.

802.11 Standard - The series of wireless standards developed by the IEEE. Commonly known as Wi-Fi.

802.11a - A wireless networking specification, assigned by IEEE, in the 5-Ghz frequency range with a bandwidth of 54 Mbps.

802.11b - A wireless networking specification, assigned by IEEE, in the 2.4-Ghz frequency range with a bandwidth of 11 Mbps.

802.11g - A wireless networking specification, assigned by IEEE, in the 2.4 Ghz frequency range with a bandwidth of 54 Mbps.

802.16 - A group of broadband wireless communications standards for metropolitan area networks (MANs) developed by a working group of the IEEE.

Access Point - A wireless hardware device connected to a wired network that enables wireless devices to connect to a wired LAN.

Analog - Modulated radio signals that enable transfer of information such as voice and data.

Bandwidth - The amount of data a network can carry, i.e., how much and how fast data flows on a given transmission path. It is measured by bits or bytes per second.

Base Station - The central radio transmitter/receiver that maintains communications with mobile radiotelephone sets within a given range.

Bits per second (bps) - The number of bits that can be sent or received per second over a communication line.

Bluetooth Wireless Technology - A short-range wireless specification that allows for radio connections (2.4 Ghz) transmitting voice and data between devices (such as portable computers, personal digital assistants, or PDAs, and mobile phones) within a 30-foot range of each other.

CDMA (Code Division Multiple Access) - A technology used to transmit wireless calls by assigning them codes. Calls are spread out over the widest range of available channels. Then codes allow many calls to travel on the same frequency and also guide those calls to the correct receiving phone.

CDPD (Cellular Digital Packet Data) - A technology that separates data files into many "packets" and sends them through empty channels of existing voice networks. It allows users to send and receive data from anywhere in a particular coverage area at any time, quickly and efficiently.

Cell - The basic geographic unit of wireless coverage. Also, shorthand for generic industry term "cellular." A region is divided into smaller "cells," each equipped with a low-powered radio transmitter/receiver. The radio frequencies assigned to one cell can be limited to the boundaries of that cell. As a wireless call moves from one cell to another, a computer at the Mobile Telephone Switching Office (MTSO) monitors the call and at the proper time, transfers the phone call to the new cell and new radio frequency. The handoff is performed so quickly that it's not noticeable to the callers.

GPS (Global Positioning System) - A worldwide satellite navigational system, made up of 24 satellites orbiting the earth and their receivers on the earth's surface. The GPS satellites continuously transmit digital radio signals, with information used in location tracking, navigation and other location or mapping technologies.

GSM (Global System for Mobile Communications) - A technology that works similarly to TDMA by dividing wireless calls into time slots. GSM is most common in Europe, Australia and much of Asia and Africa. But, GSM phones from the United States are not compatible with international GSM phones because they operate on different frequencies.

Hertz (Hz) - The unit for expressing frequency (f), a measure of electromagnetic energy. One Hertz equals one cycle per second.

Hotspot - A place where users can access Wi-Fi service for free or a fee.

LAN - Local Area Network (LAN) is a small data network covering a limited area, such as a building or group of buildings. Most LANs connect workstations or personal computers. This allows many users to share devices, such as laser printers, as well as data. The LAN also allows easy communication, by facilitating e-mail or supporting chat sessions.

Megahertz - Megahertz (MHz) is a unit of frequency equal to one million hertz or cycles per second. Wireless mobile communications within the United States occur in the 800 MHz, 900MHz and 1900MHz bands.

Network Interface Card (NIC) - A type of PC adapter card that works without wires (Wi-Fi) or attaches to a network cable to provide two-way communication between the computer and network devices such as a hub or switch.

PC Card - A credit-card-sized removable peripheral that plugs into a special slot on portable computers (and some desktop models), including Wi-Fi cards, memory cards, modems, NICs, hard drives, etc.

PCI card - (Peripheral Component Interconnect) - A hardware accessory that slots into a PC.

PCMCIA card - (Personal Computer Memory Card International Association) A credit-card sized hardware accessory that slots into a laptop.

Personal Area Network (PAN) - A casual, close-proximity network where connections are made on the fly and temporarily. Meeting attendees, for example, can connect their Bluetooth-enabled notebook computers to share data across a conference-room table, but they break the connection once the meeting is over.

Personal Digital Assistant (PDA) - is a digital handheld device that is can transmit data and services such as paging, data messaging, computing, telephone/fax, email, etc. possible.

Radio Frequency (RF) - Any frequency within the electromagnetic spectrum associated with radio-wave propagation.

Repeater - A device that receives a radio signal, amplifies it, and retransmits it in a new direction. Repeaters are used in wireless networks to extend the range of base-station signals, thereby expanding coverage—within limits—more economically than by building additional base stations.

Roaming - The ability to move from one access point coverage area to another without losing connectivity.

RSA (Rural Service Area) - One of the 428 rural markets across the United States, as designated by the FCC.

Satellite Broadband - A wireless high-speed Internet connection provided by satellites. Some satellite broadband connections are two-way—up and down. Others are one-way, with the satellite providing a high-speed downlink and then using a dial-up telephone connection or other land-based system for the uplink to the Internet.

Spectrum Allocation - Process whereby the federal government designates frequencies for specific uses, such as personal communications services and public safety. Allocation is typically accomplished through lengthy FCC proceedings, which attempt to accommodate changes in spectrum demand and usage.

TDMA (Time Division Multiple Access) - A technology that transmits information by dividing calls into time slots, each one lasting only a fraction of a second. Each call is assigned a specific portion of time on a designated channel. By dividing each call into time 'packets,' a single channel can carry many calls at once.

Unlicensed Spectrum - The government sets up general rules, such as the power limits on devices, and then allows any device that meets those standards to operate (unlicensed) in that spectrum.

Voice-Over IP (VoIP) - Technology that supports voice transmission via IP-based LANs, WANs, and the Internet.

Wide Area Network (WAN) - A network that connects computers and other devices across a large local, regional, national, or international area.

Wi-Fi Alliance - A coalition of wireless-industry leaders committed to the open interoperability of 802.11 IEEE standards.

WiMax Forum - A coalition of wireless-industry leaders committed to the open interoperability of all products used for broadband wireless access based on 802.16 IEEE standards.

Wireless Internet Service Provider (WISP) - An organization providing wireless access to the Internet.

Wireless —Use of radio-frequency spectrum to transmit and receive voice, data, and video signals for communications.